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Evaluation of the relationship between allergic rhinitis and dyslipidemia in childhood

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Abstract

Aim: There are limited data specifically evaluating the relationship between allergic rhinitis (AR) and dyslipidemia, as well as obesity in children. In this study, we aimed to evaluate the relationship between AR, dyslipidemia, and obesity.

Material and Methods: A total of 43 patients diagnosed with AR and 35 healthy children were included in the study. Laboratory records, including total cholesterol (TC), triglyceride (TG), low-density lipoproteins-cholesterol (LDL-C), high-density lipoproteins-cholesterol (HDL-C) and very low-density lipoprotein cholesterol (VLDL-C) levels, were examined. Cases were assessed in terms of body mass index (BMI). Patients with AR and normal weight were classified as Group 1 (G1), patients with AR and obesity were classified as Group 2 (G2), control group with normal weight was classified as Group 3 (G3), and control group with obesity was classified as Group 4 (G4).

Results: The mean BMI in the patient and control groups was 21.6±5.4 and 22.2±6.1 kg/m², respectively (p: 0.394). There was no statistically significant difference observed in the serum levels of TC, TG, LDL-C, HDL-C, and VLDL-C between the patient and control groups, G1 and G3, as well as between G2 and G4. A negative correlation was found between serum total immunoglobulin E (IgE) levels and TC and LDL-C values. No correlation was found between eosinophil levels, AR severity, AR persistence, and lipid profiles.

Discussion: No significant relationship was found between AR and dyslipidemia or obesity. A negative correlation was found between serum IgE levels and TC and LDL-C values.

Keywords

Allergic Rhinitis, Dyslipidemia, Obesity, Childhood

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Introduction

Allergic rhinitis (AR) is clinically defined as a symptomatic nasal disorder that occurs following exposure to a sensitizing allergen and manifests through immunoglobulin E (IgE)-mediated inflammation [1]. Allergic rhinitis is the most prevalent type of non-infectious rhinitis, causing symptoms such as watery nasal discharge, congestion, itching, sneezing, and redness and itching in the eyes, affecting 10-30% of all adults and 40% of children [2,3].

Allergic disorders, including asthma, atopic dermatitis, and AR have increased significantly in recent years, especially in industrialized countries [2]. The increased incidence of allergic diseases is believed to be associated with factors associated with the 'Western lifestyle' [4]. Dietary factors are considered to play a role in contributing to this rise in incidence [4]. Certain studies conducted recently suggest a possible link between allergic diseases and dietary factors [5,6]. These studies show that excess fat consumption and subsequent obesity, which are notable features of the modern Western dietary pattern, are associated with asthma, AR, and rhinoconjunctivitis.

Dyslipidemia is a pathological condition characterized by elevated levels of serum total cholesterol (TC), triglyceride (TG), low-density lipoproteins-cholesterol (LDL-C), and/or lower levels of high-density lipoproteins-cholesterol (HDL-C). Dyslipidemia has recently been investigated, especially in terms of its ability to modulate the immune response through the release of pro-inflammatory mediators [7]. Dyslipidemia modulates the immune response by promoting the release of proinflammatory mediators, activation of immune cells, encouraging Th-2 and Th-17 polarization, and down-regulating interleukin (IL)-10 cytokine synthesis [8]. There are views indicating that dyslipidemia results in the provocation of Th2 response or that changes in the cholesterol structure, an important component of cell membranes and signaling, affect the toll-like receptor signaling pathway, initiating an immune reaction and leading to atopic inflammation [9].

Numerous studies have investigated the relationship between dyslipidemia and allergic diseases. There are many studies, particularly examining the relationship between asthma and dyslipidemia [10,11]. A meta-analysis of eleven studies investigated the lipid profile of asthmatics and found higher LDL-C levels and lower HDL-C levels in asthma patients compared to controls [10]. High levels of HDL-C have been associated with decreased airway obstruction and lower risk of asthma. Vinding et al. have found that high levels of LDL-C and TG are associated with an increased risk of asthma and airway obstruction [11]. Although the available data in the literature suggest a strong association between dyslipidemia and allergic diseases, especially asthma, there are limited data evaluating the relationship between AR and dyslipidemia, as well as obesity. In this study, it was aimed to demonstrate the relationship between AR, obesity, and dyslipidemia.

Material and Methods

Between January 2023 and June 2023, a total of 43 patients (23 females) previously diagnosed with AR and 35 children (20 females) without any allergic or chronic diseases, who had fasting serum lipid levels previously assessed, were included in the study. Clinical and laboratory records of the cases, including total cholesterol TC, TG, LDL-C, HDL-C), and very low-density lipoprotein cholesterol (VLDL-C) levels, were retrospectively examined. Additionally, cases were assessed in terms of body mass index (BMI). The diagnosis and severity of AR were assessed in accordance with the guidelines provided by the AR and its Impact on Asthma (ARIA) initiative [1]. Patients who exhibited positive skin prick test results and experienced nasal symptoms upon exposure to these specific allergens were classified as having AR. Skin prick tests were performed using the same antigens. Skin reactions measuring 3 mm or greater than the negative control at the 15th minute after application were considered positive [12]. Patients with AR were classified according to ARIA classification, symptom severity, and duration. Intermittent AR was categorized considering the duration and frequency of symptoms, defined as symptoms lasting for less than 4 days per week and/or fewer than 4 weeks. In contrast, persistent AR was characterized by symptoms enduring for more than 4 days per week and/or exceeding 4 weeks [1]. Patients who did not experience any sleep disturbances, impairment in daily activities, leisure and/or sports activities, or negative effects on school or work performance due to the disease were classified as having mild AR. On the other hand, patients who had at least one of these symptoms were defined as having moderate-to-severe AR [1]. Patients were categorized as monosensitized (sensitized to a single aeroallergen) or polysensitized (sensitized to two or more aeroallergens) based on the number of aeroallergen sensitizations. Obesity was defined as having a BMI at or above the 95th percentile for age and gender [13]. The patient and control groups were divided into four categories based on their BMI. Patients with AR and normal weight were classified as Group 1 (G1), patients with AR and obesity were classified as Group 2 (G2), the control group with normal weight was classified as Group 3 (G3), and the control group with obesity was classified as Group 4 (G4). Dyslipidemia was defined as follows: TC >200 mg/dL, TG >150 mg/dL, LDL-C >130 mg/dL, and HDL-C <40 mg/dL[14]. Patients with comorbid conditions that may accompany AR, such as asthma, eczema, rhinosinusitis, food allergy, conjunctivitis, and/or other chronic diseases, as well as those using medications known to affect lipid metabolism (such as glucocorticoids, retinoids, immunosuppressive drugs), and those with a known diagnosis of diabetes mellitus and/or metabolic syndrome were excluded from the study. We obtained approval for the study from Dr. Lütfi Kırdar City Hospital Ethics Committee (Date: 2023-08-28, Number: 2023/514/256/2). The study was conducted in accordance with the Helsinki criteria.

Statistical analyses

The data acquired in this study underwent analysis using GraphPad Prism (statistical software, version 8.0.0). The data were presented as the mean ± standard deviation. Statistical comparisons of mean values were carried out using paired t-tests for variables following a normal distribution, and Mann-Whitney tests for variables not conforming to normal distribution. Differences among categorical variables were assessed using the chi-square test analysis. A significance level of p=0.05 was adopted for the statistical evaluations.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

The study included 43 patients with AR (23 females and 20 males) and 35 healthy control subjects (20 females and 15 males). The average age for the patients was 11.6±3.6 years, while the control group had an average age of 11.4±3.4 years. There were no statistically significant differences in age and gender distribution between the two groups. Obesity was observed in 11 (25.5%) out of 43 patients and in 10 (28.5%) out of 35 subjects in the control group. The mean BMI in the patient and control groups was 21.6±5.4 and 22.2±6.1 kg/m², respectively, and no statistical difference was observed between the groups. Dyslipidemia was detected in 3 cases (6.9%) in the patient group and 3 cases (8.5%) in the control group. No statistically significant difference was observed in the serum levels of TC, TG, LDL-C, HDL-C, and VLDL-C between the patient and control groups (Table 1).

There were no cases of prediabetes in any of the four groups. No significant differences were found in cholesterol and lipid levels between normal-weight AR patients (G1) and normal-weight control group (G3), as well as between obese allergic patients (G2) and obese control group (G4).

In AR patients, a correlation coefficient analysis was conducted to assess the correlation between immunological parameters, disease severity, sensitization status (mono/poly-sensitization), and serum lipid values. Only a negative correlation was found between serum total immunoglobulin E (IgE) levels and TC and LDL-C values (respectively, p=0.004, CI -0.6598 to -0.1451, p=0.002, CI -0.6734 to -0.1690) (Table-2). No correlation was found between eosinophil levels, AR severity (mild, moderate/severe), AR persistence, and lipid profiles (Table-2).

Table 1. Comparison of Patients with Allergic Rhinitis and Control Group.

	Study group (n= 43)	Control group (n= 35)	p
Gender (Female/male)	23/43 (% 53 Female)	20/35 (%57 Female)	0,4438
Age (years)	11,6±3,6	11,4±3,4	0,8515
*BMI (kg/m²)	21,6±5.4	22,2±6,1	0,3949
Obesity	11/43 (%25,5)	10/35 (%28,5)	0,7965
Dyslipidemia	3/43 (%6,9)	3/35 (%8,5)	0,99
Total cholesterol (mg/dL)	143,8±22,5 (107-218)	153,7±33,1 (100-208)	0,1745
Triglycerides (mg/dL)	98,9±26,6 (45-157)	115,6±63,7 (41-245)	0,16
LDL-C (mg/dL)	74±21,5 (37-144)	78,5±27,3 (34-167)	0,944
HDL-C (mg/dL)	55,3±12,3 (31-88)	50,7±11,3 (25-68)	0,2561
VLDL-C /mg/dL)	13,9±5,9 (8-30)	14,3±7,3 (8-31)	0,134

*BMI: Body mass index

Table 2. Correlation Coefficient Analysis of Serum Lipid Values, Immunological Parameters, and Disease Severity in Allergic Rhinitis Patients.

	95% confidence interval	p
Total Cholesterol-IgE	-0,6598 to -0,1451	**0,004**
Triglyceride -Ig E	-0,2401 to 0,3652	0,66
LDL-C- Ig E	-0,6734 to -0,1690	**0,002**
HDL-C- Ig E	-0,3581 to 0,2651	0,746
Total cholesterol-Eosinophil	-0.1615 to 0.2764	0,282
Triglyceride - Eosinophil	-0,4351 to 0,1781	0,37
LDL-C- Eosinophil	-0,4642 to 0,1426	0,26
HDL-C- Eosinophil	-0,1276 to 0,4761	0,222
Total cholesterol-AR severity	-0.3272 to 0.1154	0,334
LDL-C- AR severity	-0,4847 to 0,1167	0,197
HDL-C- AR severity	-0,1975 to 0,4187	0,44
Triglyceride –AR severity	-0.3767 to 0.05937	0,147
Polysensitization-Total Cholesterol	-0.3004 to 0.1447	0,478
Polysensitization –LDL-C	-0,2102 to 0,4077	0,49
Polysensitization –HDL-C	-0,4792 to 0,1236	0,213
Polysensitization -TG	-0.1365 to 0.3137	0,425
Persistent AR-Total cholesterol	-0,3766 to 0,2451	0,647
Persistent AR-LDL-C	-0,2599 to 0,3629	0,719
Persistent AR-HDL-C	-0,5092 to 0,08435	0,135
Persistent AR-TG	-0,1352 to 0,4701	0,241

AR: Allergic rhinitis, TG: Triglycerides

Discussion

The importance of serum lipid levels in the diagnosis, management, and monitoring of cardiovascular diseases and diabetes patients is widely recognized [15]. In many studies, it has been shown that dyslipidemia contributes to the susceptibility to asthma and atopy [7,10,11]. On the contrary, the role of dyslipidemia in AR has not been fully elucidated, and there are limited studies on this topic in the literature [16,17]. It is believed that allergic rhinitis is a disease with a pathophysiology similar to asthma, both being IgE-related [1]. AR was previously considered primarily as a localized disease of the nose and nasal passages, but nowadays AR is considered as a component of a systemic airway disease [1].

In this study, there were no noteworthy distinctions detected in the context of serum lipid and cholesterol levels between the patient and control cohorts. In a study that evaluated 43 adult patients with AR and a control group, similar to our results, no statistically significant difference was found between the two groups in terms of lipid profiles [17]. In another study conducted with adult patients, unlike our results, TC and LDL-C levels were found to be statistically significantly higher in AR patients compared to the control group [16]. More studies are needed to evaluate serum lipid levels among children with allergic rhinitis.

In this study, there was no significant difference observed in HDL-C levels between mono-sensitized and poly-sensitized patients. Moreover, there was no substantial association found between polysensitization and HDL-C. However, it is worth noting that the HDL-C serum level was higher in the patient group compared to the control group; nevertheless, this disparity did not attain statistical significance. A study conducted by Erel et al. on adult AR patients also showcased elevated HDL-C levels within the patient group, aligning with the outcomes of our investigation, though the distinction did not attain statistical significance [17]. Conversely, Shehan et al. discovered a statistically significant increase in HDL-C levels among adult patients with AR when compared to the control group [16]. There is evidence indicating that serum levels of

HDL-C increase in children with AR and play a pivotal role in the pathology of the disease [18]. Additionally, Vinding et al. reported that elevated HDL-C levels in children with asthma or AR mitigate the risk of sensitization to aeroallergens [11]. Therefore, multicenter studies may be necessary for further elucidating the relationship between HDL-C and AR.

No association was found between AR and obesity in this study. Furthermore there was no correlation found between the severity of AR and lipid profiles. However, a statistically significant negative correlation was observed between serum total IgE values and TC and LDL-C values. Sheha et al. reported a positive correlation between TC levels and visual analogue scale (VAS) score in their study with adult AR patients [16]. Yon et al. demonstrated a positive correlation between the severity of AR, nasal symptom scoring, and TG and TC levels in 620 pediatric patients [19]. Similarly, Ahmed et al. reported that the dyslipidemic group had a lower quality of life scale [18]. Previous studies have demonstrated that dyslipidemia promotes the secretion of Th2 and Th17 cytokine profiles while reducing IL-10 levels [20,21]. All these factors are believed to contribute to the initiation of a chronic inflammatory state that exacerbates symptoms of AR.

In this study, there was no correlation found between the persistence of AR and lipid profiles. In a study conducted on 150 adult patients diagnosed with AR, it was shown that intermittent AR increased the risk of dyslipidemia compared to persistent AR [22]. It is hypothesized that intermittent AR is associated with elevated levels of proinflammatory cytokines, which could potentially contribute to the development of an impaired lipid profile [23]. The low number of dyslipidemia cases in the patient group in this study may have affected the results.

Limitations

The most notable limitation of this study is the small sample size. Additionally, since this study is cross-sectional in nature, a longer follow-up period may be necessary to thoroughly assess the relationship between dyslipidemia and AR.

Conclusion

In this study, no significant correlation between AR and dyslipidaemia was observed. To clarify the relationship between AR and serum lipid profile in children, large-scale multicenter studies are needed. Longitudinal studies can help to better understand the causal relationship between dyslipidemia and AR, and to determine whether AR developed before or after dyslipidemia.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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